FORMATION OF H_2^+ AND ITS ISOTOPOMERS BY RADIATIVE ASSOCIATION: THE ROLE OF SHAPE AND FESHBACH RESONANCES

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The recent observations [1,2] of shape and Feshbach resonances in the high-resolution photoelectron spectra of H_2, HD and D_2 in the vicinity of the dissociation thresholds of H_2^+, HD^+ and D_2^+ raise questions concerning their potential role in the formation of H_2^+ and its isotopomers in the early universe by radiative association, a topic of astrophysical interest [3]. Close-coupling calculations for the cross sections of the reactions

$$H^+ + H \rightarrow H_2^+ + h\nu \quad (1)$$

$$H^+ + D \rightarrow HD^+ + h\nu \quad (2)$$

$$D^+ + H \rightarrow HD^+ + h\nu \quad (3)$$

$$D^+ + D \rightarrow D_2^+ + h\nu, \quad (4)$$

will be presented which take into account nonadiabatic couplings involving rovibronic and hyperfine interactions, as well as relativistic and radiative corrections. The calculated energies and widths will be compared with the experimental results of Ref. [1,2] for H_2^+ and new data for HD^+ and D_2^+. The effect of the resonances on the radiative association rate coefficients will be discussed, also in comparison with earlier studies [4].

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[4] D. E. Ramaker and J. M. Peek, *Phys. Rev. A* **13**, 58 (1976).